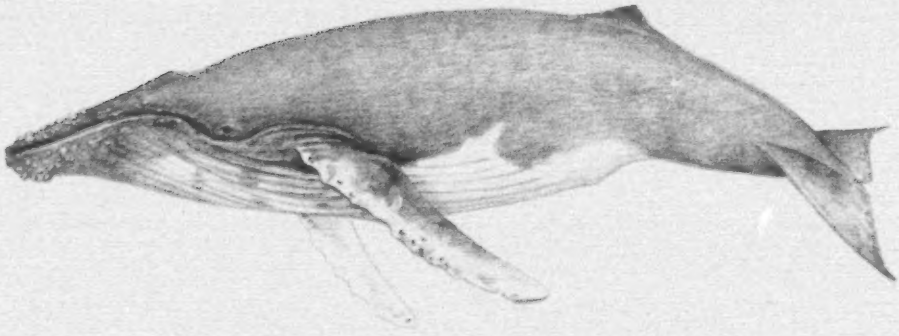
COSEWIC
Assessment and Update Status Report

on the

Humpback Whale
Megaptera novaeangliae

in Canada

North Pacific population
Western North Atlantic population



THREATENED - North Pacific population
NOT AT RISK - Western North Atlantic population
2003

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
COMITÉ SUR LA SITUATION DES
ESPÈCES EN PÉRIL
AU CANADA

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COSEWIC 2003. COSEWIC assessment and update status report on the humpback whale *Megaptera novaeangliae* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 25 pp.

Baird, R.W. 2003. Update COSEWIC status report on the humpback whale *Megaptera novaeangliae* in Canada *in* COSEWIC assessment and update status report on the humpback whale *Megaptera novaeangliae* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-25 pp.

Previous report (s):

Whitehead, H. 1985. Update COSEWIC status report on the humpback whale *Megaptera novaeangliae* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 23 pp.

Hay, K. 1982. COSEWIC status report on the humpback whale *Megaptera novaeangliae* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 22 pp.

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Également disponible en français sous le titre Rapport du COSEPAC sur la situation du rorqual à bosse (*Megaptera novaeangliae*) au Canada – Mise à jour

Cover illustration:
Humpback Whale — Illustration, Judie Shore, Richmond Hill, Ontario

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Catalogue No.CW69-14/233-2002E-IN
ISBN 0-662-32922-8

Recycled paper

COSEWIC
Assessment Summary

Assessment Summary – May 2003

Common name
Humpback whale (North Pacific population)

Scientific name
Megaptera novaeangliae

Status
Threatened

Reason for designation
Heavily reduced by whaling, the North Pacific population appears to be increasing. The number of animals that use British Columbia waters is probably in the low hundreds. The high-level of feeding ground fidelity suggests that if animals are exterminated from a particular area, it is unlikely that it will be rapidly repopulated from other areas. Two extirpated British Columbia populations have shown no sign of rescue. Humpbacks are occasionally entangled in fishing gear, though the number entangled is not thought to threaten or limit the population. In summary, humpback whales that use British Columbia waters appear to be well below historical numbers and have not returned to some portions of their former range.

Canadian occurrence
Pacific Ocean

Status history
The Western North Atlantic and North Pacific populations were given a single designation of Threatened in April 1982. Split into two populations in April 1985 (Western North Atlantic population and North Pacific population). North Pacific population was designated Threatened in 1985. Status re-examined and confirmed Threatened in May 2003. Last assessment based on an update status report.

Assessment Summary – May 2003

Common name
Humpback whale (Western North Atlantic population)

Scientific name
Megaptera novaeangliae

Status
Not at Risk

Reason for designation
Although heavily reduced by whaling, this well-studied population seems to have regrown to at least a substantial proportion of its pre-whaling size. The population does face threats (including entanglement in fishing gear, habitat degradation on breeding grounds, possible resumption of commercial whaling), but neither the North Atlantic population nor any of its breeding sub-populations is at risk from current activity levels or levels that may reasonably be foreseen in the next few years.

Canadian occurrence
Atlantic Ocean

Status history
The Western North Atlantic and North Pacific populations were given a single designation of Threatened in April 1982. Split into two populations in April 1985 (Western North Atlantic population and North Pacific population). Western North Atlantic population was designated Special Concern in 1985. Status re-examined and de-listed (Not at Risk) in May 2003. Last assessment based on an update status report.

COSEWIC
Executive Summary

Humpback Whale
Megaptera novaeangliae

Description

Humpback whales are one of the larger cetaceans, typically reaching lengths of about 13 m for males and 14 m for females. Humpbacks are easily recognizable, with their dark dorsal colouration, large size, extremely long pectoral flippers (to nearly one-third of the body length), tendency to raise their tail flukes above the surface when they dive, and frequent aerial behaviour.

Distribution

Humpback whales are found in tropical, temperate and sub-polar waters world-wide. In Canada, humpbacks are found on both the east and west coasts, extending north to Labrador in the east and into northwestern Alaska in the west. Humpbacks have long been considered a coastal species, though recent acoustic evidence shows that some individuals do use offshore areas during periods when they are not expected to be migrating. Like most other baleen whales, humpback whales exhibit seasonal migrations from high-latitude feeding areas in summer to low-latitude breeding and calving areas in winter, thus Canadian waters are used primarily for feeding.

Habitat

In the North Pacific, humpback whales feed from California north along the west coast of North America into the Bering Sea. Calving occurs in three broad areas, in the western Pacific south of Japan to the northern Philippines, in the main Hawaiian Islands, and off Mexico and central America south to Panama. Acoustic and movement evidence suggests that some exchange occurs between these breeding populations. However, individuals show considerable fidelity to feeding areas, that is, a number of discrete stocks can be defined based on feeding areas. Humpback whales in British Columbia are thought to belong to at least two distinct feeding stocks; those identified off southern British Columbia show little interchange with those seen off northern British Columbia. Humpback whales identified in the southern province show only a very low level of interchange with those seen off California/Oregon/Washington and should probably not be considered part of this stock for management purposes. Those in the northern province show some interchange with whales identified in SE Alaska that are

considered part of the "Central North Pacific" stock. There has been relatively little effort to determine the boundary of these stocks in British Columbia. Humpback whales from British Columbia have been identified in all three breeding regions in the North Pacific (Japan, Hawaii, and Mexico). Historically in the North Atlantic there were two breeding areas, in the West Indies and off the Cape Verde Islands, off western Africa. Today most humpbacks from both the western and eastern North Atlantic appear to use the West Indies for calving/breeding, though small numbers (most likely from the eastern Atlantic) may breed in the Cape Verdes. Three feeding stocks are recognized from eastern Canada: the Gulf of Maine (which includes animals from the Scotian Shelf), the Gulf of St. Lawrence, and Newfoundland/Labrador (which includes animals from the Strait of Belle Isle). Some interchange between these areas occurs, and juvenile whales from all stocks may mix in mid-latitude feeding areas off the mid-Atlantic states of the U.S.

General Biology

Gestation lasts 11 to 12 months, and a single calf is born every one to three years (average of 2.38 years in the N. Atlantic). Calves are born primarily between December and April in the northern hemisphere. Life expectancy is unknown, although maximum longevity is known to be at least 48 years. In the North Atlantic, mean age at attainment of sexual maturity for females is five years, thus females give birth (on average) at six years of age.

Population Size and Trends

The most recent population estimates available are from 1992/1993 for both the North Atlantic (11,570 individuals) and North Pacific (6,010 individuals), and both estimates are known to under-estimate true population sizes. A number of estimates for feeding stocks within these basins are also available, although reliable estimates for Canadian feeding stocks are not available. Populations in both the Atlantic and Pacific appear to be growing and may be approaching pre-whaling levels in the Atlantic.

Limiting Factors and Threats

Potential threats to humpback whales in Canadian waters today include a reduction in their prey base, incidental mortality in fisheries, ship strikes, and disturbance or injury in association with vessel traffic and/or high-intensity underwater sounds, though none of these threats are thought to currently jeopardize the growth of either population.

Existing Protection

Commercial harvesting of humpback whales has been banned by the International Whaling Commission in the North Pacific since 1965 and in the North Atlantic since 1955. The only hunting that is currently permitted is for small numbers of animals for Aboriginal subsistence purposes (St. Vincent and the Grenadines are authorized to

catch two per year). Within Canada, management of humpbacks falls under the responsibility of the Department of Fisheries and Oceans. The Marine Mammal Regulations state that "no person should disturb a marine mammal except when under the authorities of these regulations".

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.
** Formerly described as "Not In Any Category", or "No Designation Required."
*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

Update
COSEWIC Status Report

on the

Humpback Whale
Megaptera novaeangliae

in Canada

North Pacific population
Western North Atlantic population

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2003

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SPECIES INFORMATION

Name, Classification and Taxonomy

The humpback whale, *Megaptera novaeangliae* (Borowski, 1781) is the only member of the genus *Megaptera*. No subspecies are recognized. Differences in timing of reproduction, as well as pigmentation pattern differences (Pike 1953; Rosenbaum et al. 1995), suggest that northern and southern hemisphere populations are reproductively isolated. However, southeastern Pacific humpbacks may overwinter in tropical waters of the northern hemisphere, in areas also used by northern hemisphere humpbacks (Stone et al. 1990; Acevedo and Smultea 1995; Florez-Gonzalez et al. 1998), suggesting the potential for genetic exchange between northern and southern hemisphere populations (Baker et al. 1993). Based on a review of available genetic data, Baker and Palumbi (1997) note that migration between ocean basins probably occurs once or twice per generation.

Description

The humpback whale (Figure 1) is one of the larger cetaceans, with adult males and adult females typically reaching lengths of about 13 m and 14 m, respectively (Chittleborough 1965; Stevick 1999). Maximum recorded length is 17.4 meters (Chittleborough 1965). Humpbacks are easily recognizable, with their dark dorsal colouration, large size, extremely long pectoral flippers (to nearly one-third of the body length), tendency to raise their tail flukes above the surface when they dive, and frequent aerial behaviour (Figure 1). Males and females are generally similar in appearance, though females have a hemispherical lobe in the genital region (Glockner 1983), and the underside of the tail flukes in males tends to be whiter than in females (Pike 1953; Allen et al. 1994), though this latter feature cannot be confidently used to determine sex.

DISTRIBUTION

Humpback whales can be found in tropical, temperate and sub-polar waters around the world. In Canada, humpbacks are found on both the east and west coasts. On the east coast their range extends north to Labrador, while on the west coast their range extends north to northwest Alaska (Whitehead 1987). Like most other baleen whales, humpback whales exhibit seasonal migrations from high-latitude feeding areas in summer to low-latitude breeding and calving areas in winter (with the possible exception of the Arabian Sea population – Whitehead 1985; Mikhalev 1997), thus Canadian waters are used primarily for feeding. Such migrations suggest strong seasonal differences in distribution. However, in some high-latitude feeding areas in particular, it is clear that some humpbacks remain well into the breeding season, or perhaps individual variability in timing of migrations results in the presence of some individuals in high latitude areas during all months of the year (Straley 1990; Brown et al. 1995; Craig and Herman 1997; S. Todd, personal communication). In addition, there

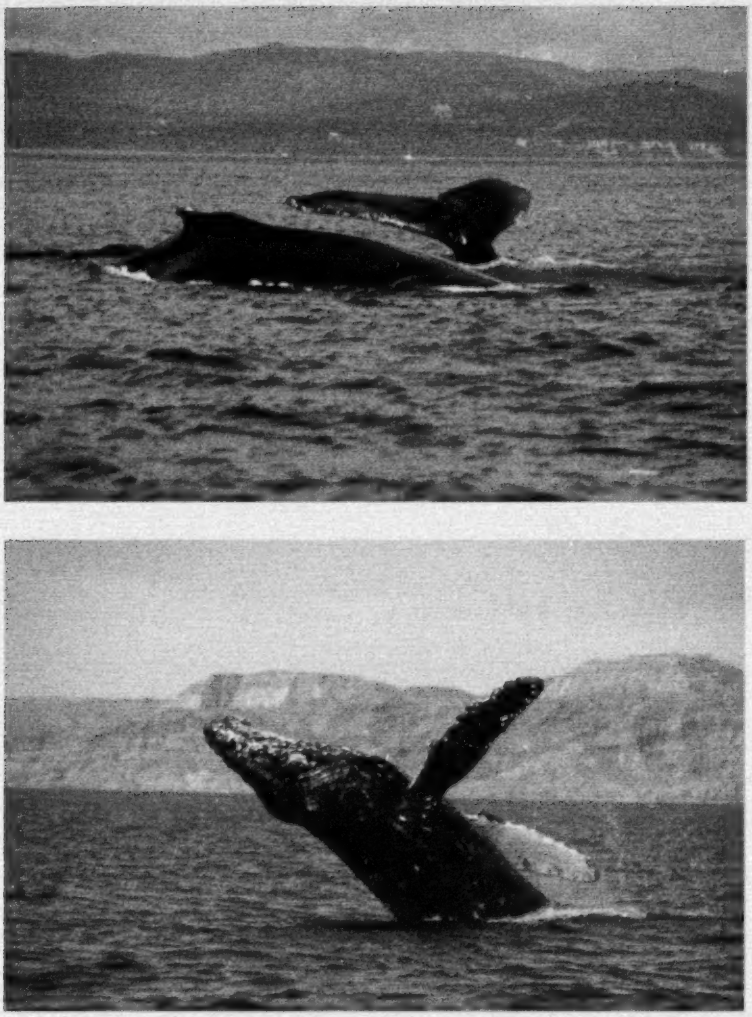

Figure 1. Top. Two humpback whales, showing the characteristic profile of the back (left) and the tail flukes being raised above the surface on a dive (right). Bottom. Humpback whale breaching, showing the characteristically long flippers. Photos by the author.

is some evidence that juveniles may remain in mid-latitude areas for feeding, while the majority of individuals have moved to lower-latitudes (Swingle et al. 1993; Laerm et al. 1997; Barco et al. 2002). Humpback whales have long been characterized as a coastal species, though recent acoustic evidence shows that some individuals do use offshore areas during periods when they are not expected to be migrating (C. Clark, personal communication). Although the occurrence of feeding in traditional breeding areas is rare, some feeding behaviour has been observed (Salden 1989; Baraff et al. 1991; Gendron and Urban 1993). Movements between feeding and breeding grounds can be both direct (Mate et al. 1998) and rapid (Gabriele et al. 1996), though relatively little is known about migratory routes or behaviour during migration (Mate et al. 1998; Norris et al. 1999).

HABITAT

In the North Pacific, humpback whales feed from California north along the west coast of North America through to the Aleutians (Figure 2). Calving occurs in three broad areas, in the western Pacific south of Japan south to the northern Philippines, in the windward Hawaiian Islands, and off the coast of Mexico and central America south to Panama. Acoustic and movement evidence suggests that some exchange between these breeding populations occurs (Payne and Guinee 1983; Baker et al. 1986; Helweg et al. 1990; Darling and Cerchio 1993; Darling et al. 1996; Calambokidis et al. 1997, 2000, 2001; Salden et al. 1999). However, both genetic and sighting data between feeding and breeding areas suggest that individuals show considerable fidelity to feeding areas, that is, a number of discrete stocks can be defined based on feeding areas (Darling and Jurasz 1983; Baker et al. 1986; Calambokidis et al. 1996, 1997; Waite et al. 1999). Baker and Palumbi (1997) note that in the North Pacific, long-term migratory exchange between some feeding populations (e.g., southeastern Alaska and central California) may be less than one individual per generation. The U.S. National Marine Fisheries Service has used this evidence to manage three discrete feeding sub-stocks in the North Pacific (see references above and Barlow et al. 1998; Hill and DeMaster 1998). They list two of these as found in British Columbia; the "California/Oregon/Washington and Mexico" stock extending to southern British Columbia to feed and the "Central North Pacific" stock feeding from northern British Columbia west to Kodiak Island, Alaska. The stock structure of humpback whales in British Columbia is more complex and not as clear.

There is some evidence that whales that feed off British Columbia represent two feeding aggregations separate from those to the north and south. Humpback whales that feed off California, Oregon, and southern Washington show a high rate of interchange among areas within this range but very low rates of interchange with the whales that feed off northern Washington and southern British Columbia, and no interchange with whales off northern British Columbia (Calambokidis et al. 1996, 2001). Additionally, no interchange has been found to date between humpback whales that have been identified off southern and northern British Columbia (Calambokidis et al. 2001; G. Ellis, personal communication). While about a half-dozen matches have been found between whales of northern British Columbia and those off southeastern Alaska, this match rate appears fairly low (Ellis and Straley, unpublished data; Calambokidis et al. 2001).

There are also differences in the migratory destinations of whales in these different feeding areas. Humpback whales that feed off California, Oregon, and Washington primarily winter off Mexico and Central America (Steiger et al. 1991; Calambokidis et al. 2000, 2001, Urban et al. 2000) and those that feed of southeastern Alaska primarily winter in Hawaii (Darling and Jurasz 1983; Baker et al. 1986; Calambokidis et al. 2001). In contrast to this, humpback whales that feed off both southern and northern British Columbia migrate to several wintering grounds without a clear preference. This has included migrations from both regions of British Columbia to Mexico (including both the mainland and the offshore Revillagigedos), Hawaii, and the breeding island of Ogasawara off Japan (Darling and Jurasz 1983; Darling et al. 1996; Urban et al. 2000; Calambokidis et al. 2001).

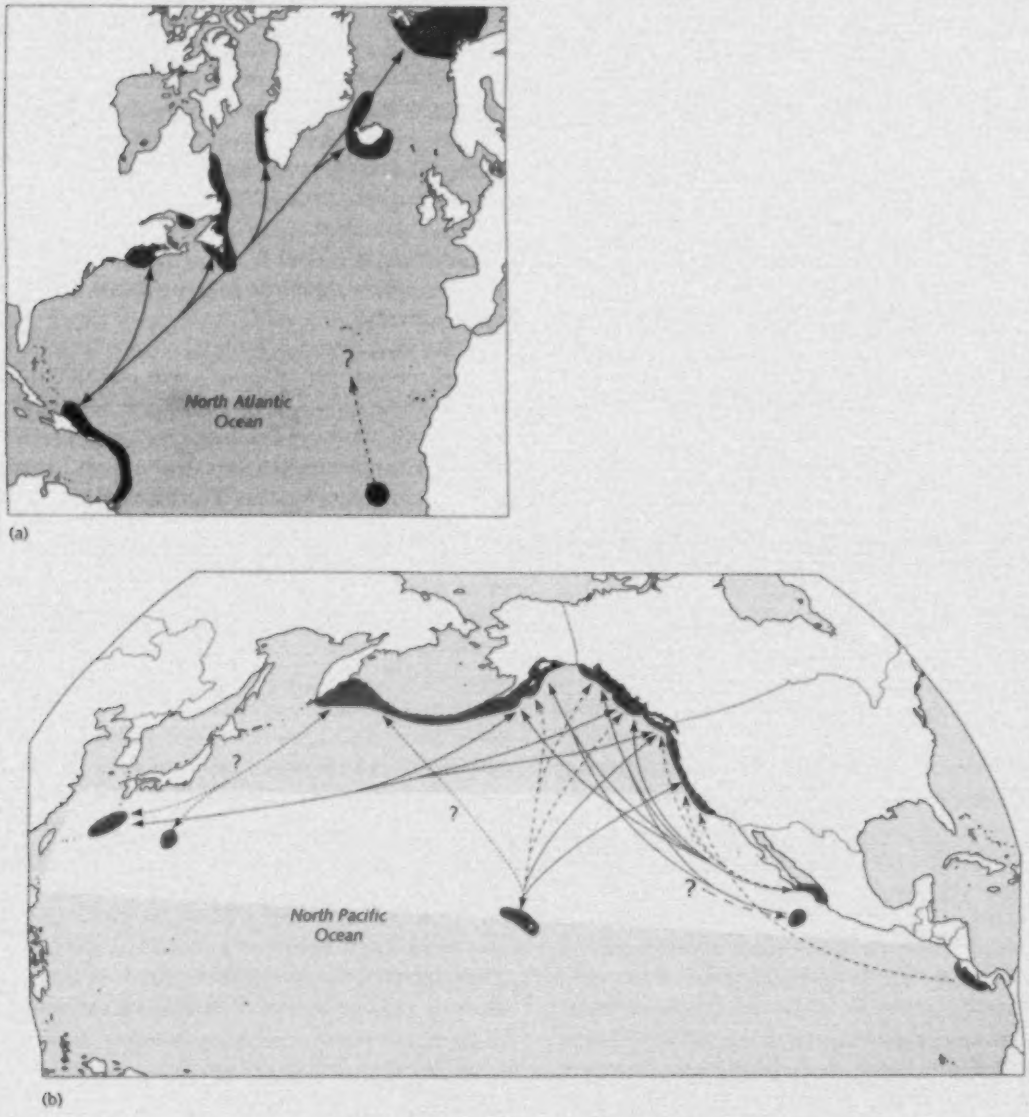

Figure 2. Humpback whale primary feeding and breeding areas (a) North Atlantic. (b) North Pacific. Feeding areas are represented by light stipple and breeding areas by dark shading. Broken arrows indicate undocumented or poorly documented migrations. In most regions, actual travel routes are not known, and arrows merely connect migratory endpoints. Map reproduced from Stevick *et al.* (2002).

In the North Atlantic, humpbacks from both the western and eastern North Atlantic appear to use the West Indies for calving/breeding (Whitehead 1982; Martin et al. 1984; Katona and Beard 1990; Larsen et al. 1996; Stevick et al. 1998, 2003), although individuals from the eastern North Atlantic are less likely to overwinter in the West Indies (Stevick et al. 2003). Small numbers of humpbacks have been observed in the eastern tropical Atlantic during winter, off the Cape Verde Islands (Reiner et al. 1996),

though it is not known which feeding population(s) these individuals are from. This area appears historically to have been a major wintering/breeding area (Reeves et al. 2002), and today may represent a secondary wintering/breeding ground for eastern North Atlantic humpbacks (Reiner et al. 1996; Hazevoet and Wenzel 2000). As with the North Pacific, considerable evidence for segregation of feeding stocks in the North Atlantic also exists, based on genetic results and photo-identification data (Clapham and Mayo 1987; Katona and Beard 1990; Clapham et al. 1993; Palsboll et al. 1995; Larsen et al. 1996; Waring et al. 2000). In the western North Atlantic four feeding stocks are recognized, three of which are found in Canadian waters. These four stocks are the "Gulf of Maine" (which includes animals from the Bay of Fundy and the Scotian Shelf; Clapham et al. 2001), the "Gulf of St. Lawrence", "Newfoundland and Labrador", and "western Greenland" (Katona and Beard 1990; Waring et al. 2000). Considerable research has been undertaken on the Gulf of Maine stock; however, in recent years less research has been undertaken on other populations. Based on genetic markers, animals from the Strait of Belle Isle appear to be from the Newfoundland/Labrador stock (P. Palsboll, personal communication). Based on photo-identification, there is a higher level of exchange of individuals between the Gulf of St. Lawrence and the Newfoundland/Labrador populations than for other populations, thus it is possible that they should be considered one stock (Anonymous 2001). Juvenile individuals from the Gulf of Maine and Newfoundland stocks do mix in mid-latitude areas during the winter months (Barco et al. 2002). The International Whaling Commission recently undertook a comprehensive review of North Atlantic humpbacks, and concluded that the appropriate unit for management is that of the feeding sub-stock (Anonymous 2001). There is evidence, however, of some spatial structuring within feeding stocks (Robbins et al. 2001), that is, there are apparently preferred feeding areas for individuals within these broader regions.

GENERAL BIOLOGY

Reproduction

Gestation lasts 11 to 12 months (Chittleborough 1958), and a single calf is born. In the northern hemisphere calves are born over a diffuse period lasting from December through April, with the peak number of births in January and February. Mating has never been positively documented, though mating-related activities (e.g., males escorting females and defending access from other males) also occurs over this same time period. Most calves are weaned at about a year of age, though a few stay with their mother for two years (Clapham 1992), and some are weaned at less than a year (Baraff and Weinrich 1993). In the North Atlantic, mean age at attainment of sexual maturity for females is five years (Clapham 1992), thus females give birth (on average) at six years of age. There is some suggestion that North Pacific humpbacks may have a later average age at first birth, though more research is necessary to confirm this (Gabriele 1992; Straley et al. 1993; J. Straley, personal communication). Humpback whales may reproduce annually, though two or three-year calving intervals are more common (Clapham and Mayo 1990; Weinrich et al. 1993; Straley et al. 1994). Barlow and

Clapham (1997) estimated a mean inter-birth interval for North Atlantic females of 2.38 years, a youngest age at first parturition of 5 years, and a calf survival rate of 0.875, giving a population growth rate of 1.065. Rates of increase of east Australian humpbacks are on the order of 10% per year (Paterson et al. 1994). Longevity is unknown, but the oldest animal recorded appears to be a 48-year-old individual from western Australia (Chittleborough 1965). However, humpbacks likely live much longer, as Chittleborough's (1965) sample was of whales taken after a considerable period of whaling, when most of the largest (and thus oldest) whales had probably already been killed.

POPULATION SIZES AND TRENDS

All humpback populations were drastically reduced due to commercial whaling; some evidence suggests that perhaps 90-95% of the world-wide population was killed (Johnson and Wolman 1984). A number of estimates from both the North Pacific and North Atlantic have been presented over the past 30 years (summarized by Whitehead 1987). Each method of estimating population size carries with it a number of biases, making comparisons between estimates difficult.

There are no rigorous pre-exploitation population estimates for either the North Pacific or North Atlantic. For the North Pacific, the pre-exploitation population has been reported at approximately 15,000 individuals (Rice 1978). The post-whaling population (1966) size has been reported from 1,200 to 1,400 individuals (Gambell 1975; Johnson and Wolman 1984), though the techniques used to produce these estimates were extremely imprecise (Calambokidis et al. 1997). Estimates from the late 1970s and early 1980s for portions of the North Pacific ranged from about 1,000-2,000 individuals (Darling and Morowitz 1986; Baker and Herman 1987). Calambokidis et al. (1997) produced the most recent estimate for the North Pacific (from 1992-1993) of 6,010 animals (SE = 474). They discuss a number of directional biases that should be taken into account, which suggest that the estimate of about 6,000 animals underestimates the true abundance (which might be closer to 8,000 individuals). Based on photo-identification results, population estimates for humpbacks off California have increased at an average annual rate of 8% between 1988 and 1998 (Calambokidis et al. 1999). Off Hawaii, based on aerial survey results from 1977-80 and from 1990, Mobley et al. (1999a) show evidence of a local increase in numbers on the Hawaiian wintering grounds (see also Cerchio 1998). Aerial surveys in Hawaii in 1993, 1995 and 1998 show further evidence of an increase in numbers, at an annual rate of 7% (Mobley et al. 1999b).

No estimates exist for numbers that use British Columbia waters, though they are probably in the hundreds. Numbers present today are only a small fraction of those found historically (Pike and MacAskie 1969; Merilees 1985; Gregr et al. 2000), though off some areas of British Columbia (e.g., the Queen Charlotte Islands) they are the most frequently reported baleen whale (Ford et al. 1994). At least 5,638 humpback whales were killed off British Columbia from 1908 to 1967, with the highest catches prior to 1917 (Gregr et al. 2000). Declines in catch rates after 1917 indicated a depletion in

these populations and this followed a different trend from the declines noted off California and Alaska, indicating the B.C. whales were part of a distinct feeding aggregation (Gregr et al. 2000). Humpback whales have not returned to all of the areas they were once common. Commercial whaling for humpback whales in British Columbia in the early 1900s including hunting of humpback whales in inside waters well into the winter. A whaling station operated at Page's Lagoon from 1907-09 and was abandoned once the supply of whales was exhausted (Tonnessen and Johnsen 1982; Webb 1988). Humpback whales remain uncommon today in the Strait of Georgia and other inside waters in this region. Off southern British Columbia and northern Washington, 115 unique humpback whales have been identified from 1990 to 2000; the entire population may not be much larger than this because only a third of the whales identified in 2000 had not been previously seen (J. Calambokidis, unpublished data). Off northern British Columbia, where analysis of a long-term dataset is still underway, the number of humpback whales appears somewhat larger with over 500 unique individuals identified from 1989 to 2001 (DFO, unpublished. data; J. Ford, personal communication).

For the North Atlantic, estimates from the mid-1800s (after some whaling had already been undertaken) were of between about 4,000 and 6,000 individuals (Reeves and Mitchell 1982; Breiwick et al. 1983; Whitehead 1987). Post-whaling estimates (from the late 1960s or early 1970s) were of between about 800 and 1,300 individuals (Mitchell 1973; Winn et al. 1975). Stevick et al. (2001) produced an estimate of 11,570 individuals (CV=0.069), for the entire North Atlantic. This estimate is known to be negatively biased (Anonymous 2001). No more recent basin-wide estimates are available. Two recent estimates are available for the Gulf of Maine. A mark-recapture estimate from 1992/93 for the Gulf of Maine indicated a population of 652 individuals (CV = 0.15; Waring et al. 2000), while a 1999 line-transect estimate for the same population was of 816 individuals (CV = 0.45; Palka 2000). Estimates for the remainder of eastern Canadian waters are problematic due to spatially uneven sampling (Anonymous 2001). For the 1992/93 period there is an estimate from eastern Canada of 2,509 individuals (CV = 0.077), though this estimate is almost certainly negatively biased due to heterogeneity in sampling (Anonymous 2001). For the West Indies breeding population, data from 1979 through 1993 suggest an annual population growth of 3% (Stevick et al. 2001).

LIMITING FACTORS AND THREATS

Natural Mortality

There are a number of potential sources of natural mortality, including predation, parasitism, disease, biotoxins, and accidental beaching or entrapment. Approximately one third of humpbacks in the western North Atlantic have been reported to have scars originating from killer whale (*Orcinus orca*) attacks (Katona et al. 1980). Clapham (2000) notes that the vast majority of individuals with killer whale scars have such scars the first time they are seen, suggesting that attacks occur primarily on calves (see also Naessig 1999). Predation by killer whales (Jefferson et al. 1991; Florez-Gonzalez et al. 1994), false killer whales (*Pseudorca crassidens* - Hoyt 1983), or large sharks (particularly on calves on

the breeding grounds – Glockner-Ferrari and Ferrari 1997; Mazzuca et al. 1998) appear to be relatively infrequent. However, Corkeron and Connor (2000) argue that avoidance of predation by killer whales in high-latitude areas may be partially responsible for the migratory behavior exhibited by this species. In terms of parasites, while humpback whales externally carry cyamid lice, it is unlikely they contribute to mortality in any way. Little is known about internal parasites or disease processes in humpback whales (Clapham 2000). Humpbacks generally do not mass strand (although S. Todd, personal communication, reports a stranding of three individuals off Newfoundland); most single stranded animals likely strand due to debilitation from disease (or wash up after being killed in fishing gear or from ship strikes, see below). One mass mortality event, associated with consumption of prey contaminated with biotoxins, has been reported from the east coast of the United States (Geraci et al. 1989), though these individuals stranded over a wide area and did not strand all at the same time. Ice entrapment occurs occasionally (Tomilin 1967; S. Todd, personal communication).

Anthropogenic Influences

Potentially negative interactions with humans fall under two broad categories. Some impacts may have acute (immediate) effects on individuals or a population, such as directed takes (whaling), entanglement in fishing gear, collisions with vessels, or exposure to acute pollutants (e.g., oil spills). Immunotoxic effects due to accumulation of persistent toxic chemicals may also have an acute impact by increasing susceptibility to diseases, thus causing an increase in mortality. Besides these acute impacts, there are a number of less tangible, longer-term, potentially negative human influences, including a reduction in reproductive rates due to immunotoxic effects, reduced prey availability due to human activities, and disturbance or displacement by vessel traffic or other sources of underwater sounds. While each of these is treated independently below, it should also be taken into account that cumulative impacts of all of these factors could be important (or in the case of longer-term stressors, synergistic interactions between impacts could occur; Whitehead et al. 2000).

Historically the primary source of direct mortality was commercial whaling, which was officially banned in the 1960s. However, there have been reports of substantial illegal whaling outside Canada since that date (Yablokov 1994; Mikhalev 1997). Whaling is strictly regulated by the International Whaling Commission, with only small numbers allowed to be killed for Aboriginal subsistence purposes. For populations that use Canadian waters, the only known hunting that currently occurs is up to two animals per year from the North Atlantic population, taken in St. Vincent. Reiner et al. (1996) report one animal taken off the Cape Verde Islands in 1988, and small numbers were taken in an Aboriginal fishery in West Greenland until 1985 (IWC 1986).

More animals are killed incidentally in fisheries each year than are killed through directed hunting (Volgenau et al. 1995; Mazzuca et al. 1998). Precise estimates of annual mortality for all Canadian populations from this source are not available. Off Newfoundland, estimates of annual mortality in fishing gear in the early 1990s ranged from 3 to 17, with a mean of 8 individuals (Volgenau et al. 1995), though previous

entanglement (and mortality) rates, associated with the inshore cod (*Gadus morhua*) fishery, were higher (Lien 1994). Reported entanglements in fishing gear off Newfoundland from 2000 through 2002 ranged from 11-22 each year, and known mortalities ranged from only 0-5 per year (Ledwell et al. 2000; Ledwell and Huntington 2001, 2002). However, some animals were last seen towing gear and may have died as a result (see above citations). Types of fishing gear/activities associated with entanglements off Newfoundland in recent years include herring nets, crab pots, whelk pots, capelin traps, cod gillnets, and unspecified gillnets and ropes/buoys (Ledwell et al. 2000; Ledwell and Huntington 2001). Fishing effort in recent years in Newfoundland has shifted offshore (J. Lien, W. Ledwell, personal communications), and entanglements in offshore areas may not be reported as frequently as entanglements in inshore areas, thus the total number of animals entangled (and killed) each year is likely greater than suggested by the above references. In British Columbia there were only four records of entanglement in fishing gear reported between 1987 and 1995 (in prawn trap gear, salmon gillnet, and lines associated with traps), none of which were known to definitely result in mortality (Langelier et al. 1990; Guenther et al. 1995). In March 1999 a juvenile humpback was killed in British Columbia after entangling with a herring roe pond net (R. Palm, personal communication). Ship strikes are also a source of mortality and injury, and in some areas may be more important than mortality in fishing gear (Wiley et al. 1995; Barlow et al. 1998; Mazzuca et al. 1998; Laist et al. 2001).

In terms of indirect impacts, the biggest potential threat to humpbacks is probably disturbance at their primary breeding sites, since these areas are limited in size, and in the Pacific, at least, are relatively near-shore and thus perhaps more subject to human influences. Disturbance or disruption of behaviour might arise from whale watching (Bauer 1997), industrial activities (e.g., seismic exploration), or other high-intensity underwater sounds (e.g., oceanographic experiments or acoustic harassment devices used in aquaculture operations (Todd et al. 1996; Nitta 1997), or military sonars (Miller et al. 2000)). Seismic activity may affect humpback whales (perhaps by displacement, disturbance, or physiological damage), but specifics are unknown. Off eastern Canada, there is overlap between seismic activity and humpback whale habitat on the Grand Banks and Scotian Shelf. However, other important areas of humpback whale habitat are not currently subject to seismic activities: inshore waters off Newfoundland and Labrador, and southwest Nova Scotia.

Because of their rather low trophic level, accumulation of persistent anthropogenic toxins is not thought to be a threat to this species (though see O'Shea et al. 1999).

Reduction of their prey base is a matter for concern; one of the primary prey species in the North Pacific, Pacific herring (*Clupea harengus*) is currently considered a candidate for listing as "Threatened" under the U.S. Endangered Species Act. The principal prey of humpback whales in the western North Atlantic is capelin (*Mallotus villosus*). There is some controversy about the current status of capelin stocks off eastern Canada (DFO 2000; Rose and O'Driscoll 2002). Capelin seem to have moved south off Newfoundland as waters cooled in the 1990s. Some indices suggest that capelin abundance has been low since about 1990; other analyses suggest that there have been relatively strong capelin year classes since about 1992 (see above citations).

SPECIAL SIGNIFICANCE OF THE SPECIES

Their tendency to inhabit nearshore areas in many parts of the world, including Canadian waters, has brought humpbacks into regular contact with humans. They are probably the most acrobatic of the large whales, and in both eastern and western Canada humpbacks are the focus of a number of commercial whale watching operations. Perhaps the feature for which they are most well known is their long and complex "song" (Payne and McVay 1971), which has received considerable attention both from the scientific community and the general public.

EXISTING LEGAL PROTECTION

Two factors are important in the legal protection of a species, the system that is in place to prohibit or regulate hunts or other threats, and how effective the system is, in terms of whether monitoring and enforcement is sufficient. Where information is available, each of these is discussed below.

International

Two international conventions are relevant to the protection of humpback whales, the Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973 (CITES) and the International Convention for the Regulation of Whaling 1946 (administered by the International Whaling Commission - IWC).

All species of cetaceans are listed by CITES under one of two appendices. Appendix I includes species threatened with extinction (and which may be affected by trade), while Appendix II includes species which may become threatened with extinction unless trade is regulated, as well as species which must be subject to regulation in order that trade in threatened species of similar appearance may be controlled (Klinowska 1991). Humpback whales, because of the large numbers of animals taken in whaling operations and the subsequent population declines, are listed in Appendix I of CITES, thus all trade is banned between countries which are Parties to CITES. As of October 1998 there were 144 Parties to CITES (including Canada), leaving approximately 90 countries world-wide which were not members (CITES Secretariat statistics).

Whaling of humpback whales is regulated by the IWC. Commercial harvesting has been banned in the North Pacific since 1965 and in the North Atlantic since 1955. Forty-one animals were killed for scientific purposes off eastern Canada between 1966 and 1971 (Mitchell 1973), and Greenland was permitted to kill 10 per year up until 1985 for Aboriginal subsistence purposes (IWC 1986). The only takes that are currently permitted are small numbers of animals for Aboriginal subsistence purposes (St. Vincent and the Grenadines are authorized to catch two per year). Canada is not currently a member of the IWC, having withdrawn in 1982 (IWC 1982).

National

Canada: Within Canada, management of humpback whales falls under the responsibility of the Department of Fisheries and Oceans. Until 1993 humpbacks were covered under the "Cetacean Protection Regulations" (under the Fisheries Act of Canada of 1867). These regulations prohibited "hunting" without a licence. "Hunting" was defined as "to chase, shoot at, harpoon, take, kill, attempt to take or kill, or to harass cetaceans in any manner". No scheme, however, was in place to enforce such regulations, and Aboriginal hunting could be undertaken without a licence. In 1993, the federal government consolidated various marine mammal regulations, including the Cetacean Protection Regulations, under the new "Marine Mammal Regulations". These regulations stated that "no person should disturb a marine mammal except when under.... the authorities of these regulations", with "marine mammal" defined as all species listed under a particular appendix. Currently, hunting of humpback whales could occur if a "Fishing Licence" was obtained (except for Aboriginals, who could hunt without a licence), and fees for such licences are low ($5). However, no such licences have been issued, and issuance is at the discretion of the federal Minister of Fisheries and Oceans. It is unlikely any would be issued in Canada due to widespread public interest in these animals.

The 1997 Oceans Act provides for the establishment of marine protected areas (MPAs) in federal waters. One of the specific justifications listed for establishing MPAs is to conserve and protect marine mammals and their habitats. However, as with other federal legislation regarding marine mammals, establishment of marine protected areas and exclusion of activities which might jeopardize humpback whales or other marine mammals is at the discretion of the Minister of Fisheries and Oceans, rather than mandated. Regardless, there are general concerns about the efficacy of using MPAs to "protect" cetaceans (Phillips 1996; Whitehead et al. 2000), due primarily to the large range of most species and the lack of boundaries in the marine environment. Whitehead et al. (2000) note that most marine protected areas have provided little or no change in the level of threats faced by cetaceans in an area.

Other Countries

Given that humpback whales that utilize Canadian waters also move between a number of different countries (potentially including at least Norway, Iceland, Greenland, Ireland, the United Kingdom, the United States, Cuba, Bermuda, the Dominican Republic, Puerto Rico, the Virgin Islands, St. Vincent, Mexico, a number of Central American countries, the Philippines and Japan), protective measures in these countries are directly relevant to the conservation of the species in Canada. In the United States, interactions between humans and humpback whales are managed though the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, the Marine Protection, Research and Sanctuaries Act of 1974 (through their presence in the Hawaiian Islands Humpback Whale National Marine Sanctuary as well as the Stellwagen Bank National Marine Sanctuary and several others), as well as a variety of other federal and state (in the State of Hawaii) regulations.

TECHNICAL SUMMARY

Megaptera novaeangliae
Humpback whale
North Pacific population
Range of Occurrence in Canada: Pacific Ocean

Rorqual à bosse
Population du Pacifique nord

Extent and Area information	
• *extent of occurrence (EO)(km²)*	>20,000 km^2
• *specify trend (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	No
• *area of occupancy (AO) (km²)*	> 20,000 km^2
• *specify trend (decline, stable, increasing, unknown)*	Decline from pre-whaling. Currently stable or increasing.
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	No
• *number of extant locations*	N/A
• *specify trend in # locations (decline, stable, increasing, unknown)*	N/A
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	N/A
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	Stable
Population information	
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	~20 years
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	500-1,000
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	Past decline, current increase
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	>50% over 60 years
• *are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?*	No
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?*	Some separation between 2 sub-populations.
• *list each population and the number of mature individuals in each*	Southern BC: ~100 Northern BC: 500+
• *specify trend in number of populations (decline, stable, increasing, unknown)*	Unknown
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	No
Threats	
Entrapment in fishing gear, ship strikes.	
Rescue Effect (immigration from an outside source)	Moderate
• *does species exist elsewhere (in Canada or outside)?*	Yes
• *status of the outside population(s)?*	Increasing
• *is immigration known or possible?*	Yes
• *would immigrants be adapted to survive here?*	Unknown
• *is there sufficient habitat for immigrants here?*	Unknown
Quantitative Analysis	Not undertaken

Megaptera novaeangliae
Humpback whale
Western North Atlantic population
Range of Occurrence in Canada: Atlantic Ocean

Rorqual à bosse
Population de l'Atlantique nord-ouest

Extent and Area information	
• *extent of occurrence (EO)(km²)*	Throughout the North Atlantic Ocean; >20,000 km^2
• *specify trend (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in EO (> 1 order of magnitude)?*	No
• *area of occupancy (AO) (km²)*	> 20,000 km^2
• *specify trend (decline, stable, increasing, unknown)*	Stable
• *are there extreme fluctuations in AO (> 1 order magnitude)?*	No
• *number of extant locations*	N/A
• *specify trend in # locations (decline, stable, increasing, unknown)*	N/A
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	N/A
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	Concern over habitat degradation in breeding grounds in Caribbean.
Population information	
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	~20 years
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	Total number, all ages: >2500. Mature individuals likely <1500
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	Increasing
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	N/A
• *are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?*	No
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?*	No
• *list each population and the number of mature individuals in each*	N/A
• *specify trend in number of populations (decline, stable, increasing, unknown)*	N/A
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	N/A
Threats	
Habitat degradation on breeding grounds in the Caribbean, entrapment in fishing gear, ship strikes	
Rescue Effect (immigration from an outside source)	Moderate
• *does species exist elsewhere (in Canada or outside)?*	Yes
• *status of the outside population(s)?*	Increasing
• *is immigration known or possible?*	Yes
• *would immigrants be adapted to survive here?*	Unknown
• *is there sufficient habitat for immigrants here?*	Unknown
Quantitative Analysis	Not undertaken

ACKNOWLEDGEMENTS

This report was undertaken under contract to the Committee on the Status of Endangered Wildlife in Canada, funded by the Canadian Wildlife Service, Environment Canada. Bob Campbell administered the contract. I would like to thank John Calambokidis, Sal Cerchio, Chris Clark, Graeme Ellis, John Ford, Christine Gabriele, Jon Lien, Joe Mobley, Per Palsboll, Jan Straley, and Hal Whitehead for providing references, unpublished information, and/or for helpful comments. Phil Clapham, Peter Corkeron, Sascha Hooker, Sean Todd, Hal Whitehead and several anonymous reviewers made a number of helpful suggestions on versions of the manuscript.

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